



# Air Pollution

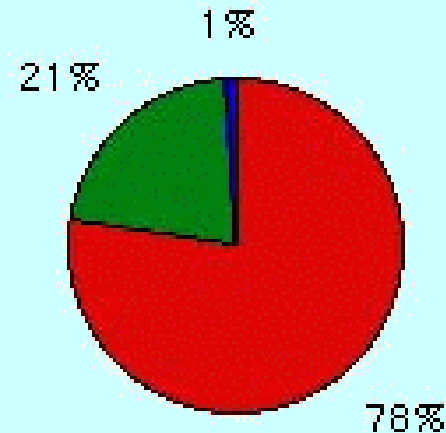


# What Causes Air Pollution?

## ■ Clean Air

- 78% nitrogen
- 21% oxygen
- 1% trace gases, including argon, carbon dioxide & water vapor  
Charlie and aj r gay

Composition of Pure Air



# Air Pollution

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- The contamination of the atmosphere by the introduction of pollutants from **human** and **natural** sources
- Most is from human activities, but can also come from natural sources (volcanoes)
  - *also include dust, pollen & spores*



## ■ Primary pollutant

- Put directly into the air by human activities
- Example: soot from smoke

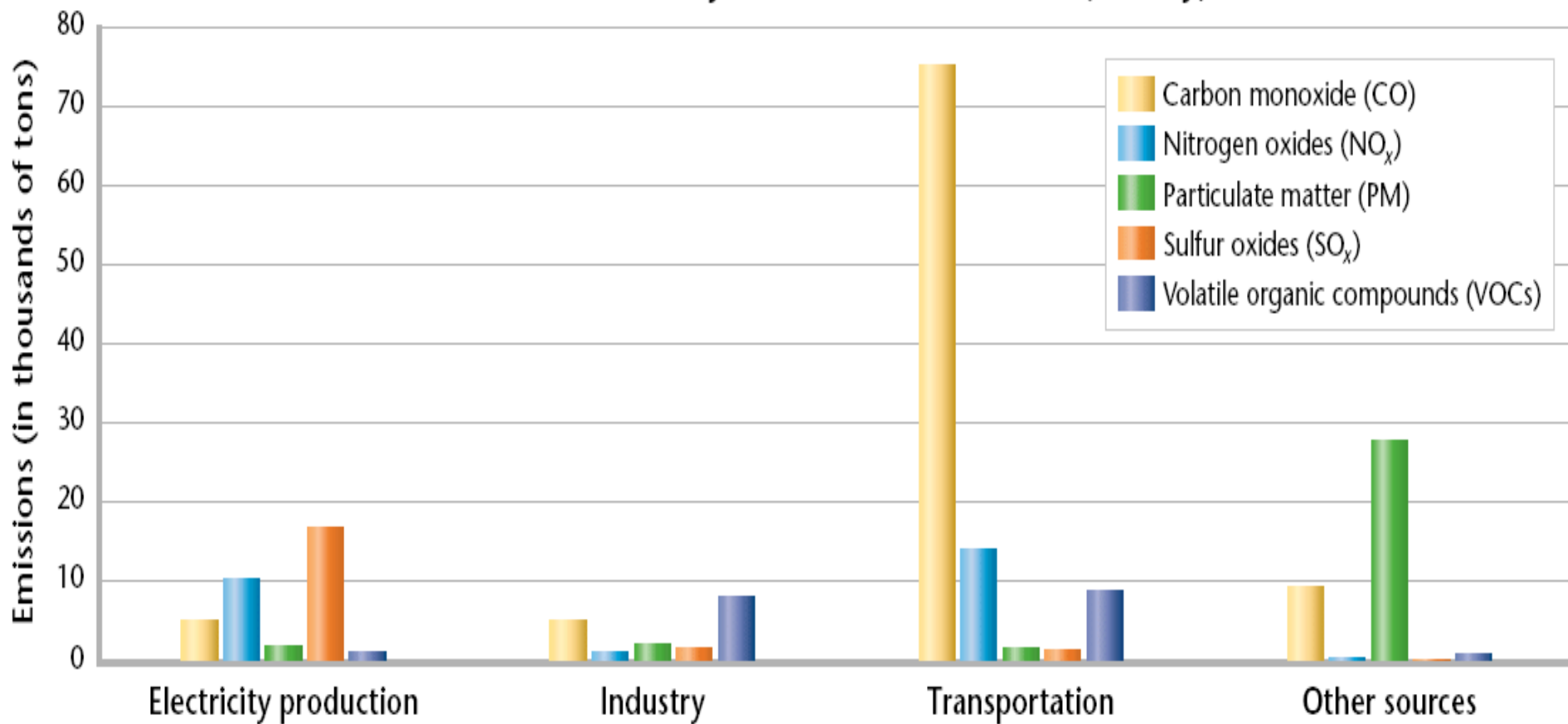
## ■ Secondary pollutants

- Form when primary pollutants react with other primary pollutants or with naturally occurring substances
- Ground-level ozone

## Primary Air Pollutants

Pollutant	Description	Primary Sources	Effects
Carbon monoxide (CO)	CO is an odorless, colorless, poisonous gas. It is produced by the incomplete burning of fossil fuels.	Sources of CO are cars, trucks, buses, small engines, and some industrial processes.	CO interferes with the blood's ability to carry oxygen, slowing reflexes and causing drowsiness. In high concentrations, CO can cause death.
Nitrogen oxides (NO <sub>x</sub> )	When combustion (burning) temperatures exceed 538°C, nitrogen and oxygen combine to form nitrogen oxides.	NO <sub>x</sub> comes from burning fuels in vehicles, power plants, and industrial boilers.	NO <sub>x</sub> can make the body vulnerable to respiratory infections, lung diseases, and cancer. NO <sub>x</sub> contributes to the brownish haze seen over cities and to acid precipitation.
Sulfur dioxide (SO <sub>2</sub> )	SO <sub>2</sub> is produced by chemical interactions between sulfur and oxygen.	SO <sub>2</sub> comes mostly from burning fossil fuels.	SO <sub>2</sub> contributes to acid precipitation as sulfuric acid. Secondary pollutants that result from reactions with SO <sub>2</sub> can harm plant life and irritate the respiratory systems of humans.
Volatile organic compounds (VOCs)	VOCs are organic chemicals that vaporize readily and form toxic fumes.	VOCs come from burning fuels. Vehicles are a major source of VOCs.	VOCs contribute to smog formation and can cause serious health problems, such as cancer. They may also harm plants.
Particulate matter (particulates or PM)	Particulates are tiny particles of liquid or solid matter.	Most particulates come from construction, agriculture, forestry, and fires. Vehicles and industrial processes also contribute particulates.	Particulates can form clouds that reduce visibility and cause a variety of respiratory problems. Particulates have also been linked to cancer. They may also corrode metals and erode buildings and sculptures.

**Sources of Primary Air Pollutants in the U.S. (Per Day)**



Source: U.S. Environmental Protection Agency.

# Motor Vehicle Emissions

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- Almost 1/3 of our air pollution comes from vehicles
- Clean Air Act (1970): gives the EPA the authority to regulate vehicle emissions
  - Eliminated lead from gasoline (reduced lead pollution by 90%)
  - Required catalytic converters (to clean exhaust gases of pollutants)

# Smog

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- Urban air pollution composed of a mixture of smoke & fog produced from industrial pollutants & burning fuels



# Ozone

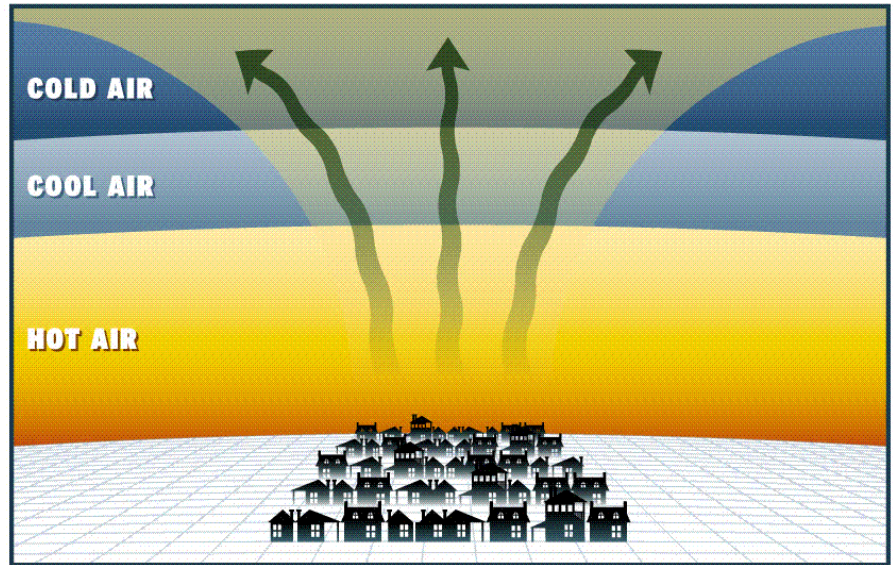
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- Forms from the reaction of VOCs and NO<sub>x</sub> in the presence of heat & sunlight
- Harmful effects on the lungs
  - Reduced lung function
  - Aggravation of asthma, bronchitis, emphysema
  - Permanent lung injury

# Temperature Inversion

- Occurs when air above is warmer than air below
- Traps pollutants near the surface

**NORMAL SITUATION**



**TEMPERATURE INVERSION**

